

WHAT IS CLAIMED IS:

1. A wide-band fiber amplifier for amplifying a first and second wavelength band of optical signals, comprising:

5 a first amplifying unit configured to (1) be pumped in at least one direction, (2) amplify the first and second wavelength bands of optical signals and (3) output Amplified Spontaneous Emission (ASE);

a second amplifying unit configured pumped by amplified ASE and configured to secondarily amplify the amplified first wavelength band optical signal; and

10 a second-band pump light source including a third amplifying unit configured to be pumped in at least one direction while being pumped by the ASE, and outputting amplified ASE, wherein the amplified ASE is used to pump the second amplifying unit.

2. The wide-band fiber amplifier according to claim 1, wherein the amplified first-band optical signal and the secondarily-amplified second-band optical signal are outputted
15 to an external optical fiber.

3. The wide-band fiber amplifier according to claim 2, wherein the first and second band optical signals are C-band and L-band optical signals, respectively.

4. The wide-band fiber amplifier according to claim 3, wherein the first amplifying unit includes a first amplifying fiber adapted to be pumped in at least one direction.

5. The wide-band fiber amplifier according to claim 4, wherein the second amplifying unit includes a second amplifying fiber adapted to be pumped by amplified ASE.

6. The wide-band fiber amplifier according to claim 5, wherein the third amplifying unit includes a third amplifying fiber adapted to be pumped in at least one direction while being pumped by the ASE.

7. The wide-band fiber amplifier according to claim 3, wherein the first amplifying unit further comprises:

a pump light source with a predetermined wavelength; and

a wavelength selective coupler pump light to the first amplifying fiber.

5 8. The wide-band fiber amplifier according to claim 7, wherein the first amplifying unit further comprises an optical isolator to allow C-band and L-band optical signals from the first amplifying fiber to pass, while blocking light in an opposite direction.

9. The wide-band fiber amplifier according to claim 3, wherein the L-band pumping light source further comprises:

10 a first pump light source to produce a first pump light with a predetermined wavelength;

a first wavelength selective coupler to output the first pumping light to the third

amplifying fiber;

a second pump light source to produce a second pumping light with a predetermined wavelength; and

a second wavelength selective coupler to output the second pumping light to the
5 third amplifying fiber.

10. The wide-band fiber amplifier according to claim 9, wherein the L-band pump light source further comprises a tunable filter for transmitting only components, corresponding to a predetermined wavelength range, of the ASE from the first amplifying unit.

10 11. The wide-band fiber amplifier according to claim 3, wherein the second amplifying unit further comprises:

a pump light source with a predetermined wavelength; and

a wavelength selective coupler to output the pump light to the second amplifying optical fiber.

15 12. The wide-band fiber amplifier according to claim 3, further comprising:

a first circulator to output (1) received C-band and L-band optical signals to the first amplifying unit, and output received ASE to the L-band pumping light source;

a first wavelength selective coupler to split C-band and L-band optical signals from the first amplifying unit and output the split L-band optical signal and output the split C-

band optical signal to the second amplifying unit;

a second circulator to output received amplified ASE from the L-band pump light source to the second amplifying unit, and output received secondarily-amplified L-band optical signal; and

- 5 a second wavelength selective coupler for receiving the amplified C-band optical signal from the second port of the and from the third port of the, to output received amplified C-band optical signal from the first wavelength selective coupler and the secondarily-amplified L-band optical signal from the second circulator.